

REMARKS

Claims 14-52 are pending. Claims 23, 24, 34 and 41-43 have been amended. Claims 23, 24, 34, 35 and 38 are the only independent claims.

Applicant notes with appreciation the allowance of Claims 35-40.

Claims 41-43 were objected to because of informalities. Those claims have been amended in the manner suggested by the Examiner without narrowing their scope. Withdrawal of the objection is requested.

Claims 14, 15, 19-26, 30-34 and 41-52 were rejected under 35 U.S.C. § 103 as obvious from U.S. Patent 5,739,587 (Sato) in view of U.S. Patent 5,923,088 (Shiue et al.) and U.S. Patent 6,265,313 (Huang). Applicant submits that amended independent claims 23, 24 and 34 are patentable over the cited art for at least the following reasons.

Amended independent claim 23 recites, inter alia, forming, through the third interlayer insulating film, a third through hole above the third wiring layer and a through aperture above the third conductive pad which is substantially wider than the third through hole; simultaneously filling the third through hole with a conductive material and leaving a conductive material covering a side wall of the through aperture so that part of the third conductive pad is exposed; and simultaneously forming an uppermost wiring layer in contact with the conductive material in the third through hole and a bonding pad on the third conductive pad in the through aperture, in the third interlayer insulating film.

In accordance with the steps recited in amended claim 23, through an insulating layer covering a lower pad and a wiring, a narrow contact hole is formed above the wiring and a wide opening is formed above the lower pad. A conductive layer is deposited to fill the narrow contact hole, but not to fill the wide opening. When etching, e.g., anisotropic etching, is done, a conductive plug connected to the wiring and a side wall in the wide

opening are formed. The conductive plug derives the wiring to the top surface, and the side wall enhances the step coverage of the upper layer. Then, the pad and the uppermost wiring are formed. Forming a conductive plug in a narrow contact hole, while forming a side wall in a wide opening enhances the step coverage, without increasing the number of manufacturing steps.

Sato shows formation of a pad with a plurality of electrode layers on interlayer insulating films and interlayer connection members through the interlayer insulating films. However, Applicant has found no teaching or suggestion in Sato of the above-mentioned recited steps relating to the side wall, or multi-layer wiring, as in amended claim 23.

Shiue also shows a pad structure comprising wide electrode layers and interlayer connection via plugs. However, Applicant has found no teaching or suggestion in Shiue of the above-mentioned recited steps relating to the side wall, or multi-layer wiring, as in amended claim 23.

Huang shows forming a barrier layer 322 covering a contact hole, and sputtering off by Ar the bottom portion of the barrier layer 322, and an oxide film 320 formed on an underlying Cu layer 304. The barrier layer on the side wall remains. The Office Action appears to view this step as corresponding to the recited forming of a side wall. However, the recited step of forming a side wall in a wide opening simultaneously forms a conductive plug in a narrow contact hole. Huang fails to teach or suggest this concept. For at least the reasons discussed above, amended claim 23 is believed patentable over the cited references.

Amended independent claim 24 recites, inter alia, forming an upper layer on the nth intermediate layer by carrying out at least the following steps: simultaneously forming a conductive pad and a wiring layer on the wiring layer being in contact with the conductive material in one or more of the through holes in the insulating film of the nth intermediate

layer; forming an upper layer insulating film on both the conductive pad and the wiring layer of the upper layer and the insulating film of the nth intermediate layer; forming, through the upper layer insulating film, an upper through hole above the wiring layer of the upper layer and a through aperture above the conductive pad of the upper layer, the through aperture being substantially wider than the upper through hole; simultaneously filling the upper through hole with a conductive material and leaving a conductive material covering a side wall of the through aperture so that part of the conductive pad of the upper layer is exposed; and simultaneously forming an uppermost wiring layer connected to the conductive material in the upper through hole, and a bonding pad on the conductive pad of the upper layer, the bonding pad being located in the upper through aperture in the upper layer insulating film.

Applicant fails to find any teaching or suggestion of the above-mentioned features in the cited references.

Amended independent claim 34 recites, inter alia, forming an upper conductive layer on a surface of the multi-level sub-structure; patterning the upper conductive layer to leave an upper wiring region and an upper pad region; forming the upper conductive layer to leave an upper wiring region and an upper pad region; forming an upper insulating layer over the upper wiring region and the upper pad region; forming, through the upper insulating layer, an upper wiring via hole above the upper wiring region and an opening above the upper pad region encompassing a region above said plurality of pad vias; simultaneously filling the upper wiring via hole with a conductive material, and leaving a conductive material covering a side wall of the opening so that part of the upper pad region is exposed; and simultaneously forming an uppermost wiring region connected to the conductive material in the upper wiring via hole and an uppermost pad region connected to the upper pad region, wherein the wiring regions and the pad regions are respectively vertically registered.

Applicant fails to find any teaching or suggestion of the above-mentioned features in the cited references.

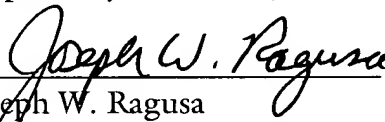
The other claims in this application are each dependent from one or another of the independent claims discussed above and are therefore believed patentable for the same reasons. Since each dependent claim is also deemed to define an additional aspect of the invention, however, the individual reconsideration of the patentability of each on its own merits is respectfully requested.

In view of the foregoing amendments and remarks, Applicant respectfully requests favorable reconsideration and early passage to issue of the present application.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

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Respectfully submitted,

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